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Effects of Temperature Abuse on Shelf Life and Color Stability on Beef Products

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Objectives

Meat color is the single most influential purchasing decision for consumers, as they associate freshness and wholesomeness with discoloration. Surface discoloration results in about 15% of retail beef being discounted and about \$1 billion in annual revenue loss. Although several factors can influence beef color, limited information is currently available on the effect of temperature abuse on beef color. Therefore, the overall goal of this study was to evaluate the effects of temperature abuse on shelf-life and color stability in beef products.

Materials and Methods

All master bags (0.4% carbonmonoxide, 30% carbon-dioxide, and 69.6% nitrogen) were kept in dark storage for 15 d before display at a temperature of -2 to 0°C . Four different treatments were utilized during the 5 d display study: (1) case at -1 to 1°C , 5 d display; (2) case at 3 to 5°C , 5 d display, (3) 8 h temperature abuse at 10°C then 5 d display, case at -1 to 1°C ; and (4) 8 h temperature abuse at 10°C and 5 d display, case at 3 to 5°C . Seven trays of strip loin steaks ($n = 28$) and top sirloin steaks ($n = 28$) were utilized for each treatment and were randomly assigned to a retail case. Surface color, biochemical, and microbiological qualities were determined during display time. Each sample was visually evaluated for lean color, surface discoloration, and overall acceptability over 5 d by a 6 member trained color panel. For the biochemical

analysis, pH, metmyoglobin reducing activity, and oxygen consumption were determined on the steaks before display. At the conclusion of color evaluation, 2 samples from each treatment were utilized for total aerobic plate count. The data were analyzed using the Mixed Procedure of SAS (SAS Inst. Inc., Cary, NC), and considered significant at a level of $P < 0.05$.

Results

Lean color and overall acceptability were not different ($P > 0.05$) for strip loin and sirloin steaks that were temperature abused prior to display, but lean color and overall acceptability were lower for steaks in warmer retail cases ($P < 0.05$). Sirloin steak discolored more rapidly ($P < 0.05$) than strip loin steaks in all treatments. The total plate counts showed no differences between treatments for sirloin steaks. However, a greater total plate count was noted in strip loin steaks that had not been temperature abused but displayed in a warmer temperature. Oxygen consumption rate, metmyoglobin reducing activity, and pH were not different between treatments.

Conclusion

Temperature abuse prior to retail display had no effect on the lean color, discoloration, or overall acceptability of the product. However, a warmer retail case had significant effect on surface color and overall acceptability of steaks. Temperature abuse prior to display combined with a warmer display case leads to shorter shelf-life.